

NEW TERMITES FROM HAWAII, CENTRAL AND SOUTH AMERICA, AND THE ANTILLES.

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This paper describes 15 new termites and a new variety, some of which are of particular interest from the standpoint of comparative morphology and of phylogeny. The following is a list of the new termites and their geographical distribution:

List of new species.

Kalotermitidae:	{	<i>Nealotermes immigrans</i> Snyder.....	}	HAWAII.....	{	Oahu, Honolulu.								
	{	<i>Neotermes connexus</i> Snyder.....		}	HAWAII.....	{	Kauai.							
	{	<i>Crotermes connexus</i> , var. <i>major</i> Snyder			}	HAWAII.....	{	Hawaii, Kaiwiki.						
	{	<i>Cryptotermes piceatus</i> Snyder.....				}	HAWAII.....	{	Oahu, Honolulu.					
	{	<i>Kryptotermes rospigliosi</i> Snyder.....					}	SOUTH AMERICA..	{	Peru.				
	{	<i>Kalotermes cubanus</i> Snyder.....						}	ANTILLES.....	{	Cuba.			
	{	<i>Kalotermes tuberculifrons</i> Snyder.....							}	ANTILLES.....	{	Mexico.		
	{	<i>Kalotermes montanus</i> Snyder.....								}	ANTILLES.....	{	Mexico.	
	{	<i>Cryptotermes thompsonae</i> Snyder.....									}	ANTILLES.....	{	Panama.
	{	<i>Coptotermes niger</i> Snyder.....										}	ANTILLES.....	{
{	<i>Coptotermes crassus</i> Snyder.....	}	ANTILLES.....										{	Spanish Honduras.
{	<i>Armitermes intermedius</i> Snyder.....		}	CENTRAL									{	Spanish Honduras.
{	<i>Constrictotermes (Tenuirostritermes) incisus</i> Snyder.....			}	AMERICA.....								{	Spanish Honduras.
{	<i>Constrictotermes (Tenuirostritermes) briciae</i> Snyder.....				}	AMERICA.....							{	Spanish Honduras.
{	<i>Anoplotermes gracilis</i> Snyder.....					}	AMERICA.....						{	Panama.
{	<i>Anoplotermes manni</i> Snyder.....						}	AMERICA.....					{	Spanish Honduras.

As classified systematically, there are eight new species and a new variety in the family Kalotermitidae and seven new species in the family Termitidae.

Genus KALOTERMES Hagen.

This genus contains a very large number of species from widely different parts of the world. It is well named, since many beautiful and striking species are included. The largest and most primitive species, *Kalotermes occidentis* Walker, occurs in North America.

Nils Holmgren has subdivided the genus *Kalotermes* into many subgenera, all of which are not adopted in this paper, since many of his subgeneric characters are only constant for the soldier caste.

The third segment of the antenna of the soldier of species of *Kalotermes* is usually enlarged and modified; the legs of the soldier have the femora swollen.

Species of *Kaloterme*s are very destructive to the interior wood-work and furniture of buildings and other timber. They are able to infest wood directly and can survive in dry wood. Species of this genus do not normally burrow in the ground; occasionally they construct galleries through the soil in artificial colonies in captivity. As in other Kalotermitidae, the impressed pellets of excrement are characteristic.

KALOTERMES IMMIGRANS, new species.

Winged adult.—Head castaneous-brown, paler posteriorly, longer than broad, rounded posteriorly, with scattering but fairly long hairs. Labrum light yellow-brown, broader than long, broadly rounded anteriorly, with long hairs. Compound eye large, larger than in *Kaloterme marginipennis* Latreille, not round, separated from the lower (lateral) margin of the head by a distance less than its diameter. Ocellus elongate, close and placed obliquely to eye.

Antennae yellowish-brown, broken; with long hairs; third segment darker, long (much longer than in *marginipennis*), slender, clavate longer than second and fourth segments; second segment shorter than fourth; antenna becoming stouter toward apex.

Pronotum slightly lighter colored than head; broader than head; twice as broad as long, the broadest part being nearer to posterior margin than in *marginipennis*; concave (emarginate) at anterior margin, posterior margin almost straight; lateral margins somewhat angularly rounded posteriorly. Pronotum with light-yellow long hairs on margins.

Wing pale but costal veins¹ yellow-brown, radial sector with 5 branches to costa, branches longer than in *marginipennis*; median vein nearer to radial sector, branched (twice) or not, reaching apex; cubitus with 13 branches, not quite reaching apex (pl. 4, fig. 15). Wing stub or scale² slightly longer than pronotum.

Abdomen with dorsum same color as pronotum, with long hairs, ventral surface paler.

Legs paler in color than abdomen.

Measurements.

Length of entire adult with wings: 12 mm.

Length of entire deilated³ adult: 5.5 mm.

Length of head⁴: 1.40 mm.

Length of pronotum: 0.705 mm.

Length of hind tibia: 1.070 mm.

Length of wing: 9.5–11 mm.

Width of head (at eyes): 1.102 mm.

Diameter of eye (long diameter): 0.307 mm.

Width of pronotum (at broadest point): 1.205 mm.

Width of wing (at widest point): 2.90 mm.

¹ "Costal veins" refer to the costa and subcosta or radial sector.

² "Wing scale" refers only to the base of the mesothoracic wing.

³ The adult after the loss of the wings is termed "deilated."

⁴ From tip of labrum to posterior margin.

Closely related to *Kalotermes marginipennis* Latreille but darker colored.

A single specimen, possibly a variety, collected at Waikiki by Ashmead is lighter colored, longer, with longer, wider head, and has the pronotum relatively shorter in proportion to its width; the wings are also longer; membrane of wing rugose between median and subcosta. More material is needed to determine whether this is merely a variety or a distinct and new species.

Soldier.—Head yellow-brown, anterior portion castaneous-brown, posterior portion pale; elongate, normally not twice as long as broad, but forms occur in which the head is nearly twice as long as broad; lateral margins nearly parallel but slightly broader anteriorly; posterior margin rounded; head with scattered but fairly long hairs. Anterior portion (front) slightly sloping forward and depressed in middle, with V-shaped dark area.

Mandibles black, not as long as width of head, stout at base, points curved in at apex, marginal teeth variable. Labrum yellow-brown, broader than long, constricted at tip, nearly truncate, with long hairs at tip.

Eye spot pale, small, separated from rim of antennal socket by a distance equal to its diameter.

Gula fairly broad in middle, at middle being about half the width in front.

Antennae pale yellow-brown, longer than mandibles, as long as width of head, 13 segments, pubescent; third segment elongate, slender, clavate, with chitin deeply colored, longer than fourth and fifth together; last segment slender and subovate.

Pronotum yellow-brown, not twice as broad as long, deeply emarginate posteriorly (angles more acute than in *marginipennis*), convex posteriorly; widest at anterior portion, anterior margins high; narrowed, but not much rounded toward posterior margin, concave in middle, where narrowest. Anterior margin darker and slightly serrate. Pronotum with scattered but fairly long hairs.

Abdomen with dorsum slightly paler than pronotum, pubescent, hairs fairly long.

Legs with femora swollen, tibiae darker.

Measurements.

Length of entire soldier: 7-9.5 mm.

Length of head with mandibles: 3.5-4.7 mm.

Length of head without mandibles: 2.4-3.2 mm.

Length of left mandible: 1.1-1.40 mm.

Length of pronotum (at corners): 1.20-1.50 mm.

Length of pronotum (at middle): 0.90-1.20 mm.

Length of hind tibia: 1.102-1.60 mm.

Width of head: 1.75-2.10 mm.

Width of pronotum: 1.75-2.10 mm.

Soldier figured by D. T. Fullaway but referred to *Kalotermes marginipennis* Latreille.⁵

The locality where the three soldiers upon which this description is based were found is Honolulu, Oahu, Hawaii, D. T. Fullaway, collector, "27/1/19." These soldiers were not found with the above typical winged adult and possibly are not this species, but are presumed to be, since *immigrans* is the only *Kalotermes* known from Hawaii.

Type locality.—Honolulu, Oahu, Territory of Hawaii.

Described from a series of winged and dealated adults collected at the type locality by D. T. Fullaway on "31, VII, '18." Winged adults were also collected at Waikiki, Oahu, and Kauai, Territory of Hawaii.

Type, winged adult.⁶—Cat. No. 24562, U.S.N.M.

Biological notes.—This new species of *Kalotermes* has been referred to in literature as *K. marginipennis* Latreille; it is believed to have been introduced into the Hawaiian Islands. Nevertheless, this termite has been present at least since 1883 (Fullaway, 1920). According to Dr. O. H. Swezey, this species (*K. immigrans*) is found in dead trees in the lowlands but not at high elevations; it occurs in telephone poles and other timbers and is said to be injurious to the woodwork and furniture in buildings. However, there are no definite records of such injury by this species, since the *Cryptotermes* which occurs in buildings (*C. piccatus* Snyder) was not known as such until a few years ago (about 1918); since then any colony which Doctor Swezey has examined occurring in furniture or the woodwork of buildings has either been of this *Cryptotermes* or of *Coptotermes intrudens* Oshima; if the colonies were large they were of the latter species.

K. immigrans Snyder swarms in June ("31, 1918," Fullaway), at Oahu, but winged adults were also collected on August 1, 1901, at Kauai (elevation 150 meters or 500 feet) by Wm. H. Ashmead. Like most species in the family *Kalotermitidae*, there is probably a long and irregular period during which winged adults emerge and fly about.

References to biological or economic literature.

1919. SWEZEY, O. H. Notes and Exhibitions. Termites in telephone poles. Proc. Hawaiian Ent. Soc., vol. 4, no. 1, June, p. 182. (*Kalotermes marginipennis*, *Cryptotermes* sp. and *Coptotermes* sp. in poles broken down during recent severe windstorm. *Coptotermes* most destructive. *Cryptotermes* had eaten from top to bottom of a 20-foot pole which had been up only five years; they fed chiefly on the outer part of the pole.)
1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294-301, Oct.

⁵ The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, fig. 2.

⁶ Where the sex of the type is not indicated, this is due to the fact that such determination only could be made at the risk of the destruction of the type.

KALOTERMES MONTANUS, new species.

Winged adult.—Head yellow-brown (pale castaneous between eyes), longer than broad, but short, broadest back of eyes; rounded posteriorly; with scattered but fairly long hairs. Eyes not quite round, large, projecting, distance from lateral margin of head equal to their diameter; ocellus large, elongate, placed obliquely to compound eye, at a distance less than its small diameter. Post-clypeus pale yellow, hind margin a straight line. Labrum broader than long, broadly rounded anteriorly, with long hairs.

Antennae yellow-brown, paler than head, longer than head, with 18 segments; with long hairs; first segment elongate, stout, cylindrical; second shorter, clavate, slightly longer than third, which is more slender and has the chitin more deeply colored; fourth shorter, wedge-shaped; fifth slightly longer; last segment slender, very short and subovate; antennae stouter toward tip.

Pronotum approximately same color as head, broader than head (not including the eyes), nearly twice as broad as long, broadest in middle, emarginate at anterior margin, posterior margin almost straight, lateral margins rounded, with long hairs.

Wings pale, costal veins dark yellow-brown; wing longer and broader than in *marginipennis*; radial sector with 6 long branches to the costa; branches between subcosta and median veins; median about half way between radial sector and cubitus, doubly branched, and does not extend to apex of wing; cubitus with 17 branches or subbranches (pl. 4, fig. 14).

Wing scale is longer than the pronotum.

Dorsal surface of abdomen with same color as pronotum, ventral surface paler, abdomen with long hairs.

Legs paler, not particularly short or stout.

Measurements.

- Length of entire winged adult: 18.0 mm.
- Length of entire deilated adult: 6.5-7 mm.
- Length of head: 2.20 mm.
- Length of pronotum: 1.10 mm.
- Length of hind tibia: 1.30 mm.
- Length of wing: 16.0 mm.
- Width of head (at eyes): 1.80 mm.
- Diameter of eye (long diameter): 0.307 mm.
- Width of pronotum: 2.00 mm.
- Width of wing (at widest point): 4.5 mm.

Although differing from the description, this may be Walker's *mexicanus*; Hagen states, however, that *mexicanus* is a synonym of *marginipennis* Latreille.

Soldier unknown.

Type locality.—Federal District of Mexico.

Type.—Described from a series of winged adults collected at the type locality by L. Conradt (No. 5), Hopk. U. S. No. 16533; winged adults have also been collected at Tacubaya, Mexico.

Type, winged adult.—Cat. No. 24563, U.S.N.M.

KALOTERMES TUBERCULIFRONS, new species.

Soldier (pl. 1, fig. 1).—Head castaneous, light yellow-brown posteriorly and darker—almost red-brown—on frontal slope, which is somewhat similar to the front of soldiers in Holmgren's subgenus *Glyptotermes*, that is, obliquely sloping, not being nearly vertical or sharply delimited as in the subgenus *Lobitermes* Holmgren. Nevertheless, this species (*K. tuberculifrons*) would probably be placed in the subgenus *Procryptotermes*⁷ Holmgren, although the front of the head is not quite vertical. Front of head greatly depressed in center (not entire front), dark in depression. Head slightly broader in front, sides slightly concave. Eye spot large, pale except for dark rim, oblique, separated from the antennal socket by a distance equal to its short diameter. Large tubercle over each antennal socket. The long diameter of the tubercle is parallel to the rim of the antennal socket. Head with short hairs.

Mandibles black—lighter at base—shorter than width of head, broad and stout at base, slender and incurved at apex, but outer rims of mandibles not curved inwards as in *K. hubbardi* Banks; left mandible with two obliquely projecting pointed marginal teeth, not as near apex as in *K. hubbardi* Banks, broad tooth near base; right mandible with pointed marginal tooth near base, at basal third. Labrum yellow-brown, broader than long, with long hairs at tip, where broadly rounded.

Antennae pale, broken, pubescent; first, second, and third segments dark-castaneous, third segment greatly elongate, slender, clavate, longer than first and second segments together; fourth segment pale brown, ringlike, shorter than second segment.

Gula slender, hardly one third as broad in middle as at tip.

Pronotum light-castaneous, anterior margin black, apparently not as broad as head, twice as broad as long; anterior margin deeply roundedly emarginate and irregularly serrate (not dentate as in *hubbardi*). Lateral margins gradually slope posteriorly (nearly parallel); posterior margin almost straight.

Meso- and meta-notum and abdomen yellow-brown; abdomen with short pubescence.

⁷ The subgenus *Procryptotermes* includes species from Madagascar. However, according to Holmgren, the winged adult is as in the genus *Cryptotermes* Banks, which is not true of North American species, which would fall into this subgenus if based on characters in the soldier caste alone; these characters are an enlarged and modified third segment of the antenna and the nearly vertical front of the head.

Legs pale, tibiae and tarsi darker, femora greatly swollen.

Measurements.

Total length of soldier (from tip of mandibles to end of abdomen): Approximately 10 mm.

Length of head with mandibles: 5.60 mm.

Length of head without mandibles and labrum: 3.70 mm.

Length of left mandible: 1.90 mm.

Length of pronotum: 1.90 mm.

Length of hind tibia: 1.70 mm.

Width of head (in front): 2.80 mm.

Close to *K. hubbardi* Banks, but constitutes a distinct species on account of its tuberculate front of head and other divergent characters.

Winged adult unknown; this soldier may belong to the winged adult *K. montanus* Snyder.

Type locality.—"Mexico."

Described from a single soldier in the collection of the United States National Museum labeled "Mexico."

Type, soldier.—Cat. No. 24564, U.S.N.M.

KALOTERMES CUBANUS, new species.

Soldier (pl. 1, fig. 2).—Head castaneous-brown, dark on anterior area (especially the front), paler on posterior area; twice as long as broad, about equally broad at anterior and posterior margins, lateral margins slightly concave. Postclypeus castaneous, broader than long, posterior margin convex. Labrum yellow-brown, broader than long, broadly rounded at apex, with long hairs. Head with scattered but fairly long, erect hairs on both dorsal and ventral surfaces. Eye spot much smaller and less deeply pigmented than in *Kaloterme jouteli* Banks, on a line with and close to antennal socket.

Mandibles black, stout, and very broad at base; left mandible with two pointed marginal teeth near tip, broader tooth nearer base; right mandible with two broader and larger pointed teeth below those on left mandible. Tips of mandibles pointed and curved in.

Antennae yellow-brown, first three segments castaneous; 17 segments, longer than mandibles, with long pubescence; third segment larger than second, or fourth, clavate, deeply colored; last segment short, slender, and subovate.

Gula much narrower in middle than in *jouteli*, the width at the middle being less than half the width at the front (fig. 1).

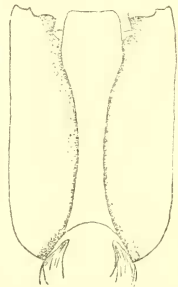


FIG. 1.—*KALOTERMES CUBANUS*. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Pronotum yellow-brown, with dark anterior rim, not quite twice as broad as long in middle, broader than head, front roundly emarginate, broadest anteriorly, anterior margin high at corners; lateral margins rounded, gradually narrowing posteriorly; posterior margin nearly straight; pronotum with long hairs on margins.

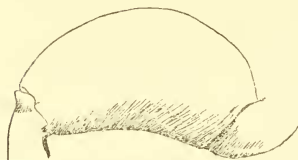


FIG. 2.—*KALOTERMES CUBANUS*. SOLDIER. HIND FEMUR. GREATLY ENLARGED.

Abdomen about same color as pronotum, ventral surface paler, with short, light-colored pubescence.

Legs paler in color; tibiae and tarsi darker, femora greatly swollen (fig. 2).

Measurements.

Total length of soldier: 13.5 mm.

Length of head with mandibles: 5.75 mm.

Length of head without mandibles and labrum: 3.80 mm.

Length of left mandible: 1.90 mm.

Length of pronotum (not in middle but from anterior to posterior corners): 1.80 mm.

Length of hind tibia: 1.80 mm.

Width of head: 2.75 mm.

Width of pronotum: 3.00 mm.

Close to *Kaloterмес jouteli* Banks of Florida and *K. mona* Banks of Mona Island, the Antilles, but with distinctive structural differences, a prominent character being the broad mandibles; in *mona* the third segment of the antenna is longer.

Type locality.—Las Playuelas, Pinar del Rio, Cuba.

Described from a large series of soldiers collected at the type locality by B. T. Barreto, No. 8616, January, 1921.

Type, soldier.—Cat. No. 24565, U.S.N.M.

Genus *NEOTERMES* Holmgren.

A genus closely related to the genus *Kaloterмес* Hagen, widely distributed over the world. If based upon the soldier caste alone, *Neoterмес* probably would only deserve rank as a subgenus. This is suggested from the soldier of *N. connexus* Snyder, which is intermediate between the two genera *Neoterмес* and *Kaloterмес*. However, the wing venation of the sexual adults of species of *Neoterмес* renders it a valid genus.

In habits the various species of *Neoterмес* are more forest inhabiting and they seem to be more dependent on moisture than in case of species of *Kaloterмес*; apparently they are not as injurious to the woodwork of buildings as are species of *Kaloterмес*.

NEOTERMES CONNEXUS, new species.

Winged adult.—Head dark castaneous-brown, anteriorly darker than posteriorly, not much longer than broad, rounded at base. Trace of frontal gland depression on line with posterior border of compound eyes. Head with scattered but long hairs on dorsum and margins. Compound eye not quite round, large, projecting, separated from lower (lateral) margin of head by a distance less than its diameter, scarcely two diameters from hind margin. Ocellus large, elongate, set obliquely to eye, almost touching it. Post-clypeus castaneous-brown, much broader than long. Labrum lighter colored than head, elongate, constricted toward apex, nearly truncate on tip, with long hairs.

Antennae yellow-brown, 17 to 19 segments; with long pubescence; first segment long, stout, subcylindrical; second shorter but elongate and clavate; third clavate, shorter than second, chitin more deeply colored; fourth more wedge-shaped, shorter than third; fifth longer; last segment slender, subovate.

Pronotum slightly paler than head, broader, anterior margin deeply concave; nearly twice as broad as long, shorter than wing stub or scale, rounded posteriorly and emarginate; margins with fairly dense long hairs.

Abdomen with dorsum about same color as pronotum, ventral surface paler; abdomen with long hairs.

Legs yellow-brown, tibiae darker.

Wing much longer than entire deälated adult, radial sector with 5-7 long branches to costa and several short branches; cubitus with 17 branches, not reaching apex (pl. 4, fig. 16).

Measurements.

- Length of entire winged adult: 17.5 mm.
- Length of entire deälated adult: 8.0 mm.
- Length of head: 2.00 mm.
- Length of pronotum: 1.30 mm.
- Length of hind tibia: 1.50 mm.
- Length of wing: 13.5 mm.
- Width of head (at eyes): 1.80 mm.
- Diameter of eye (long diameter): 0.405 mm.
- Width of pronotum: 2.05 mm.
- Width of wing: 4.0 mm.

The winged adult is allied to *N. castaneus* Burmeister.

Soldier.—Head shading in color from light yellow posteriorly to, yellow-brown anteriorly and more castaneous at anterior margin; head longer than broad, lateral margins varying from short and rounded to longer and parallel, as is common in species of *Kaloterme*s. Eye spot purplish, oblong, placed obliquely to side of head, separated from antennal socket by distance equal to its short diameter. Head with long scattered pubescence on the lateral margins.

Labrum yellow, not much broader than long, broadly rounded at apex (almost truncate), with long pubescence.

Mandibles black, castaneous-brown at base, base stout and broad, tip pointed; left mandible with two pointed marginal teeth near tip, a third lower rudimentary tooth and a broader "molar"; right mandible with one marginal pointed tooth at about the middle of mandible and another pointed tooth at base.

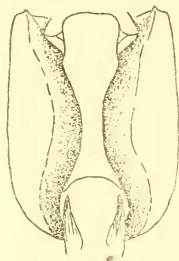


FIG. 3.—NEOTERMES CONNEXUS. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Antennae yellow-brown, 15 segments, with long pubescence; first segment elongate, stout, cylindrical; second shorter, clavate; third castaneous-brown, clavate (slender at base), longer than second but not as long as fourth and fifth together, which are short and ringlike (slightly wedge-shaped); segments narrower toward apex; last segment slender and subovate.

Gula short and much narrowed in middle (fig. 3).

Pronotum yellow to yellow-brown, anterior margin deeply concave, posterior margin nearly convex but with slight emargination, not broader than head, much broader than long; pronotum with long hairs on lateral margins.

Abdomen dirty gray-white with tinge of yellow, with long hairs.

Legs with hind femora swollen (fig. 4), tibiae and tarsi darker.

Measurements.

Length of entire soldier: 10.5–11.7 mm.

Length of abdomen and thorax together: 5.25–6.75 mm.

Length of head with mandibles:

4.25–4.95 mm.

Length of head without mandibles:

3.10–3.20 mm.

Length of left mandible: 1.65–1.70 mm.

Length of pronotum: 1.25–1.45 mm.

Length of hind tibia: 1.35–1.40 mm.

Width of head: 2.35–2.45 mm.

Width of pronotum: 2.35–2.45 mm.



FIG. 4.—NEOTERMES CONNEXUS. SOLDIER. HIND FEMUR. GREATLY ENLARGED.

Soldier figured by D. T. Fullaway, but referred to *Neotermes castaneus* Burmeister.⁸

The series of soldiers upon which this description is based were found on the mountains of Oahu, Honolulu, Hawaii, Swezey collector, May 21, 1920, Hopk. U. S. No. 14199; soldiers with deilated adults.

Type locality.—Kauai, Territory of Hawaii.

⁸ The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, pl. 1, fig. 1.

Described from several winged and deälated adults, collected at type locality by B. P. Clark in March, altitude 915 meters (3,000 feet); winged adults were also collected at Olaa; soldiers with deälated adults were found on the mountains of Oahu, Honolulu, Territory of Hawaii.

Type, winged adult.—Cat. No. 24566, U.S.N.M.

This species, the "mountain form" of "*Calotermes*" of Hawaii, appears to be the "missing" or connecting link between the genera *Kalotermes* Hagen and *Neotermes* Holmgren, hence the specific name "*connexus*." The adult is clearly a *Neotermes* due to its characteristic wing venation; the soldier, however, is a *Kalotermes* on account of its swollen femora and enlarged third segment of the antenna with the chitin deeply colored. Nevertheless, certain other known species of *Kalotermes* have the soldier with the third segment of the antennae simple, as *K. simplicicornis* Banks of Texas.

Biological notes.—A "mountain form"—a native Hawaiian termite—has long been known to exist.⁹ This termite was referred to in literature as "*Calotermes castaneus* Burmeister." However, it is the above described *Neotermes connexus*. It is a true forest insect, confining itself entirely to the decaying or sometimes the living wood of trees; this termite is found only in the mountain forests, but occurs on all the islands.

This species of *Neotermes* with *Kalotermes immigrans*, formerly considered to be *marginipennis* Latreille, are widespread in Hawaii. While *Kalotermes immigrans* is considered to have been introduced to the islands (Bryan, 1915), *N. connexus* is endemic.

Winged adults of *N. connexus* have been collected at Kauai, elevation 915 meters (3,000 feet), in March, B. P. Clark, and at Olaa, elevation 800 meters (2,600 feet), in May, H. W. Henshaw. *K. immigrans* swarms in June, "June 30, 1918" (Fullaway).

References to biological or economic literature.

1915. BRYAN, W. A. Natural history of Hawaii. Honolulu, Hawaii, 1915, termites, p. 402. *Calotermes marginipennis* (introduced species); *C. marginipennis*, p. 425; *C. castaneus* (Hawaiian species), p. 425.
1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294-301, Oct.

NEOTERMES CONNEXUS, var. MAJOR, new variety.

Deälated adult.—Head dark castaneous-brown, somewhat darker anteriorly, shining; not much longer than broad, rounded at base, with scattered fairly long hairs. Compound eye not quite round, large, projecting, separated from lateral margin of head by a distance less than its diameter. Ocellus large, elongate, set obliquely

⁹ R. McLachlan, Ann. Nat. Hist., ser. 5, vol. 12, 1883, p. 227; Perkins, F. H. 11 (2). p. 88.

and close to eye. Labrum yellow-brown, somewhat tongue shaped, broadest in middle, broadly rounded at tip—nearly truncate, with long hairs.

Antenna yellow-brown, broken, with light yellow, long hairs; first segment long, stout, cylindrical; second shorter than first, more clavate; third somewhat darker colored, shorter than second, clavate; fourth short, about half as long as third, ringlike; fifth longer than fourth; antenna becomes gradually wider towards apex.

Pronotum slightly paler than head, broader, anterior corners turned down, anterior margins deeply concave, posterior margin plainly emarginate, nearly twice as broad as long, shorter than wing scale, long hairs on margins. Pronotum and wing scale longer than in *N. connexus* Snyder.

Abdomen with longer hairs than in *connexus*.

Legs with femora more enlarged than in *connexus*.

Measurements.

Length of entire deilated adult: 10.75–11.0 mm.

Length of head: 2.35–2.45 mm.

Length of pronotum: 1.30 mm.

Length of hind tibia: 1.70 mm.

Width of head (at eyes): 1.95–2.05 mm.

Diameter of eye: 0.408 mm.

Width of pronotum: 2.35+–2.45+ mm.

Soldier unknown.

More material is needed to determine whether this is merely a variety of *N. connexus* or a distinctive species. It is darker colored, larger, head and pronotum larger than in *connexus*; pronotum with posterior margin plainly emarginate; pronotum and wing scale with more numerous and longer hairs. The third segment of the antenna is longer and more clavate than in *N. connexus*; the last segment of the maxillary palpi is longer.

Type locality.—Kaiwiki, Hawaii, Territory of Hawaii.

Described from two deilated adults collected at the type locality by W. H. Ashmead in July; Acc. No. 38341. Kaiwiki is near Hilo—being a few miles above—at an elevation of 610 to 915 meters (2,000 to 3,000 feet).

Type, deilated adult.—Cat. No. 24675, U.S.N.M.

Genus CRYPTOTERMES Banks.

In 1906, Nathan Banks created the genus *Cryptotermes* for a termite from Florida, the soldier of which has a uniquely cavate head (*C. cavifrons*). Until recently this has been a genus of comparatively few known species. These are of local distribution, being apparently restricted to the Tropics or subtropical regions. There are several new species from the West Indies and South America.

In America there are six described species of *Cryptotermes*: *C. ("Calotermes") brevis* Walker of Florida (Key West and Miami), Cuba, and Central and South America; *C. cavifrons* Banks of Florida; the very peculiar and characteristic *infumatus* Banks of Texas; and three species from Panama, all recently described by Banks (1919), namely: *brevicollis*, *dudleyi*, and *longicollis*; *longicollis* is described from the soldier caste alone.

According to Holmgren (1910), "*Calotermes*" *posticus* Hagen, from the West Indies, and "*Calotermes*" *solidus* Hagen, habitat unknown, also may belong to the genus *Cryptotermes*. Banks, however, considers *posticus* to be a *Calotermes*.

Within both the genus and species there is considerable variation in the wing venation and size and shape of the antennal segments of the winged adult.

Species of *Cryptotermes* are very destructive to the interior woodwork of buildings and furniture. They are able to live in dry wood and penetrate wood directly. They do not live in the ground.

CRYPTOTERMES ROSPIGLIOSI, new species.

Winged adult.—Head castaneous, with a darker area between the eyes, lighter at front just behind post-clypeus. Head quadrangular, rather than elliptical, longer than broad, not as sharply narrowed at base as in *Cryptotermes brevis* Walker, few scattered short hairs. Tips of mandibles black. Labrum large, broadly rounded at front, with short pubescence on tip. Compound eye large, not quite round, nearly reaching to the antennal socket, separated from lateral margin of head by a distance less than its diameter; ocellus large (larger than in *C. brevis*), elongate, pointed at apex, at right angle to and close to the compound eye.

Antennae stout, longer than head, with 16 segments, slightly darker than the legs, pubescent, segments gradually become longer and wider toward apex; basal segment cylindrical, elongate; second clavate, elongate, longer than third, second and fourth subequal; third to fifth as broad as long; sixth slightly longer; seventh to ninth more elongate; from tenth on elongate and clavate; last segment narrower and oval.

Pronotum where broadest, near the base, slightly broader than head, approximately twice as broad as long. Anterior margin slightly concave, narrow, posterior margin nearly straight; lateral margins with fairly long hairs, longer than in *C. brevis*. A black dot anteriorly on each side. Pronotum rounded off more sharply at base than in *C. brevis*.

Abdomen, especially at end, with scattered but fairly long pubescence; ventral surface pale; cerci not prominent.

Legs, except tibiae, pale yellow, tibiae slightly darker.

Wing long; as usual, iridescent and hyaline, the costal veins yellowish-brown; wing not as broad as in *C. brevis* (pl. 5, fig. 20); in forewing the median is bent up to subcosta, beyond the middle of the wing (touching at about the fourth branch of the radial sector), radial sector with numerous branches to the costa (at least six). The cubitus runs out nearly straight toward tip of the wing (pl. 5, fig. 17).

Measurements.

Length of entire winged adult: 11.5–12 mm.

Length of entire deiluted adult: 5+ mm.

Length of head: 1.45 mm.

Length of pronotum: 0.70 mm.

Length of hind tibia: 0.607 mm.

Length of anterior wing: 6.75 mm.

Width of head: 1.15 mm.

Diameter of eye: 0.207–0.300 mm.

Width of pronotum: ? (curled down).

Width of anterior wing: 2.10 mm.

Soldier caste unknown.

Close to *C. brevis*, but larger and lighter colored; the other specific characters are in head, thorax and wings. Type compared with a winged adult from Brazil, determined by Hagen, now in the collection of the Museum of Comparative Zoology, Cambridge, Massachusetts.

At the suggestion of Doctor Martini, this species is named in honor of Doctor Rospigliosi, Director of the Museum of Natural History of Lima, Peru.

Type locality.—Lima, Peru.

Described from three winged adults, collected at the type locality (near Lima, Peru) by Dr. Ezekiel A. Martini (No. 20), March 4, 1918. Hopk. U. S. No. 15278.

Type, winged male adult.—Cat. No. 24567, U.S.N.M.

CRYPTOTERMES PICEATUS, new species.

Winged adult.—Head castaneous-brown (piceous), darker colored than in *Cryptotermes brevis* Walker, quadrangular, longer than broad, rounded at base, lateral margins of head approximately parallel; few scattered hairs on surface—fairly long. Labrum large, broader than long, broadly rounded at apex with fairly long pubescence. Compound eyes large, nearly round, separated from the lower (lateral) margin of head by a distance less than their diameter, and distant from the posterior margin of head by a distance equal to over twice their diameter. Ocellus fairly large, almost touching compound eye, rounded.

Antennae paler colored than head, yellow-brown; 17? segments, broken; with fairly long pubescence; first segment long, stout, cylin-

dricl; second clavate, slightly longer than the third which is nearly equal to the fourth; fifth also clavate, longer than fourth; last segment elongate, slender, subovate.

Pronotum slightly lighter colored than head, broader than head, approximately twice as broad as long, not as long as the wing scale. Pronotum deeply concave anteriorly, slightly convex posteriorly. Pronotum broader toward posterior margin; with long pubescence.

Wings with golden yellowish-brown costal veins; in forewing median is bent up to subcosta beyond middle of wing, touching at a point from the second to the fourth or fifth branch of the radial sector; radial sector with 7 branches to the costa; cubitus with numerous branches (14) and branched beyond middle of wing to margin before reaching apex (pl. 5, figs. 18 and 19).

Abdomen with same color as pronotum, paler on ventral surface; with scattered pubescence.

Legs paler in color than pronotum.

Measurements.

Length of entire winged adult: 11-12 mm.

Length of entire deilated adult: 4.5-5.0 mm.

Length of head: 1.20 mm.

Length of pronotum: 0.605 mm.

Length of hind tibia: 0.607 mm.

Length of wing: 9.5 mm.

Width of head: 1.05 mm.

Diameter of eye (long diameter): 0.207 mm.

Width of pronotum: 1.20+ mm. (slightly curled down).

Width of wing: 2.30 mm.

Soldier.—Very similar to the soldier of *C. brevis* Walker. The piceous black color of the anterior area of head and rugose areas extend posteriorly much further than in *brevis*. Anterior area of pronotum darker. Front of head more deeply emarginate and sunken. Eye spot present, but due to the darker color of the head, is not as distinct as in *brevis*; mandibles apparently not as long as in *brevis*.

Measurements.

Length of entire soldier: 4+ mm.

Length of head with mandibles (closed): 1.90 mm.

Length of head without mandibles: 1.70 mm.

Height of head (at anterior margin): 1.10 mm.

Length of pronotum (at corners): 0.80 mm.

Length of pronotum (in middle): 0.505 mm.

Length of hind tibia: 0.802 mm.

Width of head: 1.30 mm.

Width of pronotum: 1.30 mm.

Figured by D. T. Fullaway,¹⁰ but referred to *Cryptotermes brevis* Walker.

¹⁰ The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, pl. 1, fig. 4.

The single soldier upon which this description is based was found at Honolulu, Oahu, Territory of Hawaii, D. T. Fullaway, collector, "3, 2, '19."

Type locality.—Honolulu, Oahu, Territory of Hawaii.

Described from several winged adults collected at the type locality by D. T. Fullaway, "10."

This termite is closely related to *C. brevis* Walker.

Type, winged adult.—Cat. No. 24568, U.S.N.M.

Biological notes.—According to Fullaway (1920), this species of *Cryptotermes* has been present in Hawaii at least since 1904. With *Coptotermes intrudens* Oshima it is responsible for the greater part of the destruction of the woodwork of buildings, furniture, and other timber. Both species are supposed to have been introduced into Hawaii and are at present confined principally to Honolulu, although spreading rapidly.

Records show that *Cryptotermes piceatus* swarms in May ("5/4/19," Fullaway). Flights occur from dusk on into the night and often occur after a rain (Fullaway, 1920).

References to biological or economic literature.

1919. CRAWFORD, D. L. Notes and Exhibitions. Proc. Hawaiian Ent. Soc., vol. 4, no. 1, June, p. 13. (*Coptotermes*, sp. destroying boxes in warehouses near water front. *Cryptotermes*, sp. destroying shooks in the bundle.)
1920. FULLAWAY, D. T. Notes and Exhibitions. Proc. Hawaiian Ent. Soc., vol. 4, no. 2, June, p. 249. (*Cryptotermes*, sp. small colony containing laying queen exhibited.)
1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294-301, Oct.
1921. FULLAWAY, D. T. *Cryptotermes brevis* in Hawaii (Isoptera). Proc. Hawaiian Ent. Soc., vol. 4, no. 3, Sept., pp. 456-457. (Known to have been in Hawaii previous to 1904.)

CRYPTOTERMES THOMPSONAE, new species.

Winged adult (pl. 2, fig. 4).—Head yellow-brown, head slightly darker than pronotum, lighter colored than *Cryptotermes brevis* Walker; head quadrangular, longer than broad, not as broad at base as at apex (longer and broader than in *C. brevis*); few scattered, fairly long hairs on head. Labrum light yellow, large, narrowed toward apex, where rounded, with fairly long pubescence. Compound eyes not circular, separated from the lower (lateral) margin of the head by a distance equal to less than the long diameter. Ocellus small, elongate, at oblique angle to compound eye, placed more obliquely to eye than in *C. dudleyi* Banks, distant less than its diameter from eye. Triangular, hyaline markings with a fairly large, pale, whitish, oblong, central spot anteriorly on head, in front of where fontanelle depression would be located.

Antennae yellow-brown, stouter than in *dudleyi*, 17 segments, pubescent; first segment long, stout, cylindrical; second short, clavate;

third longer, clavate, slender at base, chitin more deeply colored; fourth not quite as long as second and not much broader; fifth longer; last segment long and slender, sub-ovate; segments become broader toward apex.

Pronotum broader than head, lighter colored, pronotum not as long as the wing scale, lateral margins at base rounded more than in *brevis*, less parallel, longer and wider than in *brevis*. Pronotum widest at apex: in *brevis* widest in center.

Wings with costal veins golden yellowish-brown, not as broad as in *brevis*; in the forewing the median vein is bent up to the subcosta beyond the middle of the wing touching at approximately the second branch of the radial sector; radial sector with 5 branches to the costa; cubitus with numerous branches (12), branched to apex slightly beyond middle.

Abdomen same color as pronotum, paler on ventral surface, with scattered but fairly long pubescence, less stout than in *dudleyi*.

Legs paler than pronotum, tibiae somewhat darker.

Measurements.

Length of entire winged adult: 9.75–10 mm.

Length of entire deilated adult: 4.5–6 mm.

Length of head: 1.80 mm.

Length of pronotum: 0.70 mm.

Length of hind tibia: 0.807 mm.

Length of anterior wing: 6.50 mm.

Width of head (at eyes): 1.00 mm.

Diameter of eye (long diameter): 0.300 mm.

Width of pronotum: ? (curled down).

Width of anterior wing: 1.90 mm.

Soldier (pl. 2, figs. 5 to 9).—Front of head and mandibles black (mandibles with reddish tinge), remainder of head shading respectively from reddish, anteriorly, to light yellowish-brown, posteriorly. Head elongate, not tuberculate as in *C. brevis* Walker although edge of ridge is roughened; head and mandibles longer than in *brevis*. Scattered, erect hairs on surface of head. Small, oblique, oval eye spot back of antenna plainly visible.

Antenna very pale except first 3 segments which have the chitin colored; 13 segments, pubescent; first segment elongate, cylindrical; second clavate, shorter than first; third shorter than second, narrower, clavate; fourth broader than third but shorter; segments increase in width to last segment which is slender, elongate, oval.

Mandibles visible from above, with marginal teeth; mandibles more slender than in *brevis*.

Pronotum dark in front, broader than long but not nearly twice as broad as long; deeply angularly emarginate anteriorly, borders coarsely serrate in front, long hairs on sides, short erect hairs on sur-

face; pronotum longer and more deeply cleft than in *C. brevis*. Sides broadly rounded posteriorly, hind margin slightly emarginate.

Measurements.

Length of entire soldier: 5-6 mm.

Length of head with mandibles: 2.15-2.40 mm.

Length of head without mandibles: 1.20-1.40 mm.

Length of left mandible: 0.95-1.0 mm.

Height of head: 1.20 mm.

Length of pronotum (at corners): 0.80-0.90 mm.

Length of hind tibia: 0.807 mm.

Width of head: 1.35-1.40 mm.

Width of pronotum: 1.35-1.40 mm.

The series of soldiers upon which this description is based were found at Ancon, Canal Zone, Panama, J. Zetek and I. Molino, collectors, "6/21/21," from dry oak baseboard of revolving bookcase, Acc. No. Z. 1498; it was not found with the type of the winged adult, but with metatypes—deälated, sexual adults.

Fritz Müller¹¹ writes:

Calotermes smeachmani und *C. hagenii* unterscheiden sich von anderen bekannten arten dadurch, dass bei den Soldaten der aufgebogene Vorderrand des Prothorax gezähnel ist. Auch die Kopfbildung der Soldaten ist eine sehr eigenthümliche. Bei den Soldaten von *C. smeachmani* finden sich Flügel-scheiden an Mittel- und Hinterbrust, die bei denen des *C. hagenii*, wie bei denen unserer anderen *Calotermes*-Arten fehlen.

Holmgren (1910) founded his new subgenus *Eucryptotermes* on the single species *hagenii* of Fritz Müller; it is a South American invalid species, apparently closely related to *Cryptotermes thompsonae* Snyder.

Silvestri¹² states:

È probabile che una delle due specie date da Fritz Müller (Jen. Zeit. VIII, p. 341, nota 3) con il nome di *Calotermes smeachmani* e *C. hagenii* sia uguale al mio *C. taurocephalus* e l'altra al *C. triceromegas*, però le descrizioni che abbiamo sono tanto brevi, che non permettono assolutamente fare con sicurezza tali identificazioni.

C. triceromegas Silvestri appears to be a *Cryptotermes* and is closely related to *thompsonae*.

The deeply serrate front margin of the pronotum of the soldier is a striking character in *thompsonae*.

This species is named in honor of Dr. Caroline Burling Thompson, Professor of Zoology at Wellesley College, Wellesley, Mass., in recognition of her valuable work on the morphology of termites.

Type locality.—Ancon, Canal Zone, Panama.

Described from a series of winged and deälated adults, collected at the type locality by H. F. Dietz, "V-7," "9-11-16, 1919"; Dietz Acc. No. G. 541, Hopk. U. S. No. 14174; collected flying at night in room in Hotel Tivoli.

Type, winged adult.—Cat. No. 24569, U.S.N.M.

¹¹ Jenasche Zeitschrift für Medizin und Naturwissenschaft, vol. 7, 1871-1873, p. 341, note 3.

¹² Redia, vol. 1, 1903, p. 26.

Genus *COPTOTERMES* Wasmann.

Some of the most destructive species of termites in the world to the woodwork of buildings and other timber belong to this genus. *Coptotermes formosanus* Shiraki is capable of dissolving lime mortar by secretions from the tubular frontal gland, according to Oshima.

Species in the genus *Coptotermes* are widely distributed throughout the world, but the genus is apparently not rich in species.

Fortunately, no species occurs in the United States.

The soldier caste is distinctive, having a short tubular projection on the front of the head, that is, the opening of the frontal gland.

COPTOTERMES NIGER, new species.

Winged adult.—Head very dark, castaneous-brown to black. Head elliptical but longer than broad, broadest at eyes, with long pubescence. Fontanelle a round depression between compound eyes. Eyes nearly round, distant less than their diameter from lower margin of head, about an eye diameter from front of head, slightly projecting. Ocellus its long diameter distant from eye, placed obliquely to eye. Post-clypeus yellow-brown, much broader than long. Labrum yellow-brown, elongate, somewhat tongue-shaped, longer than broad—broad at base—rounded at tip; with long golden-yellow pubescence.

Antennae light brown, longer than head, 21 segments, pubescent; first segment long, stout, cylindrical; second approximately half the length of first; third short; fourth rounded, longer, but not as long as second, becoming stouter towards apex; last segment long, slender, subovate.

Pronotum same color as head, nearly twice as broad as long, not broader than head, subcordate; both anterior and posterior margins slightly emarginate but anterior margin more concave, posterior margin nearly straight, lateral margins with long pubescence.

Wing scale slightly longer than pronotum; with long pubescence; wings dark gray-brown, ciliate, 12 mm. in length; short pubescence on surface of wings. Median nearer to cubitus, normally with 2 branches at apex; cubitus with 17 branches, or subbranches (pl. 5, fig. 21).

Dorsal surface of abdomen same dark color as head and pronotum, with long pubescence; ventral surface of body yellow-brown, with long golden-yellow pubescence.

Legs yellow-brown.

Measurements.

- Length of entire winged adult: 13–13.5 mm.
- Length of entire deilated adult: 6.5–7.0 mm.
- Length of head: 1.60–1.65 mm.
- Length of pronotum (at corners): 0.90 mm.
- Length of hind tibia: 1.30 mm.

- Length of anterior wing: 10.5-11.5 mm.
 Length of wing scale: 1.0 mm.
 Diameter of eye: 0.300-0.307 mm.
 Width of head: 1.30-1.40 mm.
 Width of pronotum: 1.30-1.40 mm.
 Width of anterior wing: 3.00-3.25 mm.

Winged adult darker and smaller than that of *Coptotermes marabitanus* Hagen: compared with the type of the latter in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Soldier.—Head yellow-brown, slightly darker on anterior portion; shorter than in *marabitanus*; broadest posteriorly back of longest hairs or bristles on margin of head; tapers toward anterior area more sharply than in *marabitanus*, more pointed at apex (fig. 5); with light yellow, long, scattered hairs on dorsum and lateral margins, also on ventral surface from anterior to posterior areas. Gula slightly broader and shorter than in *marabitanus* but not as broad as in *crassus* Snyder; breadth in middle about half that at anterior area (fig. 5). Mandibles castaneous-brown to black, curved at tip, long, more slender than in either *marabitanus* or *crassus*. Left mandible with marginal teeth at base less prominent than in *crassus*.

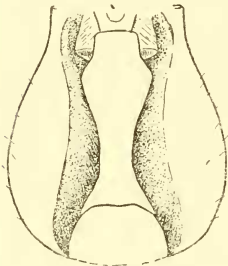


FIG. 5.—*COPTOTERMES NIGER*. SOLDIER. VENTRAL VIEW OF HEAD SHOWING GULA. GREATLY ENLARGED.

Labrum castaneous-brown, elongate, subtriangular, less sharply pointed than in *crassus*, slightly constricted at tip, two long hairs on tip.

Antennae light yellow-brown, 14 segments, pubescent; first segment long, cylindrical, stout; second shorter, but longer than third or fourth; fifth approximately equal to second; last segment short, slender, subovate.

Pronotum light yellowish, not as long as in *crassus* or even in *marabitanus*, with long hairs.

Abdomen dirty white with tinge of yellow, with long pubescence. Legs light yellow, elongate, slender.

Measurements.

- Length of entire soldier: 4-4.50 mm.
 Length of head with mandibles: 2.0-2.1 mm.
 Length of head without mandibles: 1.20-1.30 mm.
 Length of left mandible: 0.80-0.85 mm.
 Length of pronotum: 0.40 mm.
 Length of hind tibia: 0.800-0.902 mm.
 Width of head (at widest point): 1.15-1.20 mm.
 Width of pronotum: 0.702-0.750 mm.

The large series of soldiers upon which this description is based were found at Gamboa, Canal Zone, Panama, H. F. Dietz, collector,

"V, 14, 1919." Dietz Acc. No. G. 550, Hopk. U. S. No. 14174h—"in old post"; they were not found with the typical winged adult but are probably the same species, since winged adults of only one species of *Coptotermes* have been so far collected at Panama.

Type locality.—Juan Mina, Canal Zone, Panama.

Described from a large series of winged adults collected at the type locality by H. F. Dietz, "V, 14, 1919," Dietz Acc. No. G. 546, Hopk. U. S. No. 14174c; specimens of winged adults were also collected at Panama City, Panama, and Ancon, Canal Zone.

Type, winged male adult.—Cat. No. 24570, U.S.N.M.

COPTOTERMES CRASSUS, new species.

Soldier.—Head yellow-brown, slightly darker on anterior portion; head longer and stouter than in *Coptotermes marabitanus* Hagen; broadest at longest bristles or hairs on lateral margins near posterior margin—about half way between antennal socket and posterior margin of head; not twice as broad as pronotum; tapers anteriorly (fig. 6); scattered pubescence (long) on dorsal surface and lateral margins. Eye spot visible. Gula broader (wider in middle) than in *C. marabitanus*; more than half as broad at middle than at anterior margin (fig. 6). Mandibles black, long, slender, curved at tip, light colored at base; broader at base than in *marabitanus* or *niger* Snyder; four rudimentary marginal teeth at base of left mandible as in *marabitanus*. Labrum castaneous-brown, longer than broad, not as long as in *marabitanus*, broader at base; elongate subtriangular, tip constricted, with two long hairs.

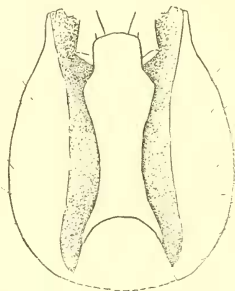


FIG. 6.—COPTOTERMES CRASSUS. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Antennae light yellow-brown, extend beyond mandibles, 14-15 segments, less slender than in *marabitanus*, light colored pubescence on antennae; first segment elongate, stout, subclavate; second short; third shorter than second or fourth; last segment short, slender and subovate.

Palpi same color as antennae, elongate, slender, more slender than in *niger*.

Pronotum light yellowish, twice as broad as long, larger than in *marabitanus*; long pubescence on lateral margins and on surface.

Abdomen dirty white with tinge of yellow, with long pubescence.

Legs yellow, stouter than in *marabitanus*.

Soldier shorter and stouter—more robust than in *marabitanus*; compared with the type of *marabitanus* in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Measurements.

- Length of entire soldier: 5-6 mm.
- Length of head with mandibles: 2.20-2.45 mm.
- Length of head without mandibles: 1.40-1.50 mm.
- Length of left mandible: 0.90-0.95 mm.
- Length of pronotum: 0.305-0.406 mm.
- Length of hind tibia: 1-1.005 mm.
- Width of head (at widest point): 1.102-1.35 mm.
- Width of pronotum: 0.805-0.95 mm.

Type locality.—San Juan Pueblo, Spanish Honduras, which is in the hills north and inland from Ceiba, which is on the coast.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February-March, 1920; soldiers were also found at Lombardia and Ceiba, Spanish Honduras.

Type, soldier.—Cat. No. 24571, U.S.N.M.

Genus ARMITERMES Wasmann.

In this interesting genus the soldier caste is an intermediate between the mandibulate soldier and the "nasutus" or soldier with a nasus or beak, since soldiers of species of *Armitermes* have both mandibles and a nasus. The relative lengths of the mandibles and nasus vary with the species and are of taxonomic value. *A. intermedius* Snyder has mandibles and nasus of approximately equal length, hence the specific name. In front view, the head of the soldier reminds one of the head of an elephant.

The nasus is an organ of defense as well as the mandibles and is probably a more effective weapon in nasuti than the mandibles in the mandibulate soldiers; a sticky substance is exuded which "gums up" ants and other enemies.

There is a remarkable progressive development of the frontal gland from *Reticulitermes* Holmgren, where it is merely a circular opening ("retrocerebral" gland) up through *Mirotermes* Wasmann, *Coptotermes* Wasmann, *Cornitermes* Wasmann, *Armitermes* Wasmann, to *Nasutitermes* Banks and *Constrictotermes* Holmgren, where the mandibles are rudimentary and the nasus long and well developed. Even in the Kalotermitidae or lower termites there is a slight trace of the frontal gland.

The "nasute" soldier is merely a more highly specialized mandibulate soldier and a much more useful member of the colony—a mutant or "segregant" worth while.

In *Rhinotermes* Hagen the minor soldier, the "gabel nasutus" of authors, has the labrum extended into a slender tube, forked at the tip. In *Armitermes intermedius* the tip of the labrum is hollow and tubular.

ARMITERMES INTERMEDIUS, new species.

Soldier (pl. 1, fig. 3).—Head yellowish-brown, nasus slightly darker on sides; head much broader but shorter than in *A. heterotypus* Silvestri, longer than broad, somewhat retort shaped in lateral view; broadest at base, tapers anteriorly, rounded at base; few long hairs or bristles on anterior and posterior margins of head. Gula elongate, slender, tapering anteriorly, lateral margins dark castaneous-brown. Nasus slightly shorter than width of head at anterior margin where head is least broad; nasus broadest at base tapering to apex, slightly emarginated at tip; end of nasus directly over tip of labrum (in lateral view); short hairs on apex of nasus.

Mandibles dark castaneous-brown to black except at base where yellow-brown; mandibles when closed extending beyond tip of nasus. Mandibles curved, broad at base, slender at apex; marginal tooth near middle, with its outer edge near the inner margin of mandible and distinctly parallel to margin of mandible; inner edge of marginal tooth forming a sharp angle with the mandible.

Labrum broadest at base, yellow-brown, tapering to apex, where it is membranous, white and looks like a hollow, white, fleshy tube; covered with long golden-yellow pubescence.

Antennae yellow-brown, longer than head, slender, 15–16 segments, with long pubescence; first segment long, stout, cylindrical; second shorter, more slender, subclavate; third clavate, slightly longer than second; fourth and fifth subequal and approximately equal in length to third, or slightly longer than third; sixth longer; antennae becoming more clavate-shaped and slender at seventh segment; last segment subovate and slender.

Pronotum yellow-brown on posterior margins; saddle-shaped; broadest at middle, nearly twice as broad as long; rounded at apex, posterior half trapezoidal, long pubescence on lateral margins.

Abdomen gray with tinge of yellow, with long, golden-yellow pubescence.

Legs yellowish, long and slender.

Measurements.

Length of entire soldier: 5.75–7.25 mm.

Length of head with mandibles: 3.1–3.35 mm.

Length of head without mandibles (to base labrum): 2.15–2.30 mm.

Length of left mandible: 1.25–1.35 mm.

Length of head with nasus: 2.75–2.95 mm.

Length of nasus: 0.95–1.2 mm.

Length of abdomen and thorax together: 4.0–4.85 mm.

Length of pronotum: 0.50–0.60 mm.

Length of hind tibia: 1.80–2.00 mm.

Width of head (at widest point): 1.90–2.15 mm.

Width of pronotum: 1.15–1.20 mm.

Worker.—Head yellowish-white, longitudinal grayish markings, not much longer than broad, broadest anteriorly, rounded posteriorly; post-clypeus bulging, twice as broad as long. Antennae yellowish-brown at apex, 15 segments; first segment long, stout and cylindrical; second shorter, more slender; third slightly longer than second.

Pronotum saddle-shaped, yellowish.

Abdomen gray.

Legs yellowish, long, slender.

Measurements.

Length of entire worker: 5.0–5.75 mm.

Length of abdomen and thorax together: 3.80–4.10 mm.

Length of head: 1.65–1.75 mm.

Length of hind tibia: 1.25–1.30 mm.

Width of head: 1.40–1.50 mm.

Described from a series of workers found with the typical soldier.

A striking species of *Armitermes*; the wide head of the soldier, short nasus and position of the marginal tooth are very distinctive.

Type locality.—Ceiba, Spanish Honduras.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, of the Bureau of Entomology, U. S. Department of Agriculture; in rotten log, February–March, 1920; soldiers and workers were also found at Lombardia, Spanish Honduras.

Type, soldier.—Cat. No. 24572, U.S.N.M.

Genus *CONSTRICOTERMES* Holmgren.

In 1910, Holmgren divided the genus *Eutermes* Fritz Müller into many subgenera; however, certain American species do not readily fall into these subgenera. In 1920, Banks adopted the name *Nasutitermes* for one *Eutermes* form and raised the subgenus *Constrictotermes* Holmgren to generic rank.

In general, the different species of the genus *Constrictotermes* (as used in a broad sense by Banks) are similar to those of the genus *Nasutitermes*; however, the head of the soldier or nasutus is always constricted. Nevertheless, the species *diversimilis* Silvestri, from South America, has three different types of soldiers and has been placed in the subgenus *Diversitermes* Holmgren. Yet, if the contour of the head alone were considered, the "large" soldier or nasutus would fall in the genus *Nasutitermes*, whereas the "middle" and "small" soldiers would be placed in the genus *Constrictotermes*. However, there are other striking characters in the nasute caste, namely, the length of the legs, the number of hairs on the head, etc., which vary considerably in the different subgenera. In the worker caste the relative length and width of the post-clypeus is of subgeneric value. Most of the described species are from America. In

comparison with the many species in the genus *Nasutitermes*, this genus may be considered as composed of but few species.

Except for the fact that the nasuti have few hairs on the head, whereas there are quite a number of hairs or bristles on the heads of the soldiers of species of *Tenuirostritermes*, the two species of *Constrictotermes* to be described in this paper, namely, *incisus* and *briciae*, would fall into Holmgren's subgenus *Tenuirostritermes*. This subgenus has only one type of nasutus and it has shorter legs than in the subgenus *Velocitermes* Holmgren. Furthermore, the species do not construct semispherical, carton, "niggerhead" tree nests. In *Tenuirostritermes* the post-clypeus of the worker is about as long as half its breadth (twice as broad as long).

The subgenus *Velocitermes* includes species which have two types of nasuti or soldiers, with few hairs on the head and with long legs; the mandibles are somewhat longer than in soldiers of species of *Tenuirostritermes*. Species of *Velocitermes* do not construct carton tree nests.

In the subgenus *Constrictotermes* Holmgren (restricted sense), the species have only one type of nasutus, with peculiarly constricted head and with many hairs on the head. Species are included in this genus which do construct carton tree nests.

C. incisus and *briciae* have only one type of nasutus, so far as known (only one has been collected). There are but few hairs on the head; the mandibles are extremely short (much shorter than in species of *Tenuirostritermes*); the legs of the soldier are as long as in species of *Tenuirostritermes*. In the worker the post-clypeus is about twice as broad as long. Neither of these new species were found in carton tree nests. Hence, I place them in the subgenus *Tenuirostritermes*.

CONSTRUCTOTERMES (TENUIROSTRITERMES) INCISUS, new species.

Soldier (pl. 3, figs. 10 and 11).—Head dark castaneous-brown, almost black, with a lighter brown color on base of head around the base of the antennae and at the tip of nasus. Ventral portion of head also lighter colored. Head deeply constricted (angles acute), with basal portion approximately one and one-half times as long as apical portion (without the nasus)—basal portion longer than the nasus, also broader than the apical portion; head rounded posteriorly, basal portion of head dorsally with one long bristle on each side where head is widest. Nasus same color as head, long and slender; pointed at apex where lighter colored and with short pubescence. The head forms an angle with prothorax.

Antennae yellowish-brown, 13 segments, with long pubescence; first segment elongate, stout and cylindrical; second short, approximately half the length of first, clavate; third long and tapering, clavate, slender at base, nearly as long as first; fourth approximately equal

to second; fifth longer than fourth but not as long as third; last segment long, slender and subovate.

Pronotum yellow-brown, saddle-shaped, wider than long (narrow), with short hairs on anterior margin, posterior margin emarginate. Meso- and meta-notum and dorsum of abdomen yellow-brown. Abdomen with long, golden-yellow pubescence, ventral surface paler.

Legs yellow-brown, long and slender.

Measurements.

- Length of entire soldier or nasutus: 2.75-3 mm.
- Length of head with nasus: 1.20-1.45 mm.
- Length of head without nasus (to anterior of head): 0.90-1.00 mm.
- Length of nasus: 0.405-0.50 mm.
- Length of abdomen and thorax together: 1.75-2.00 mm.
- Length of pronotum: 0.105 mm.
- Length of hind tibia: 0.900-0.906 mm.
- Width of head (at widest point): 0.50-0.505 mm.
- Width of pronotum: 0.307 mm.

Worker.—Head castaneous-brown, lighter at base of antennae, broadest anteriorly, longer than wide, tapers where rounded posteriorly, with short pubescence. Post-clypeus yellow-brown, about twice as broad as long, projecting (raised). Labrum yellowish, broadest at middle, rounded at apex, tapers posteriorly, pubescent on anterior area.

Antennae yellow, longer than head, 13-14 segments, with long pubescence; first segment long, stout, cylindrical; second clavate, short, half length of first; third longer than second, clavate, slender at base, not as long as first; fourth clavate, short, approximately as long as second; fifth clavate, longer; last segment long, slender, subovate.

Pronotum lighter colored than head, saddle-shaped, broader than long (narrow), with short pubescence on anterior and lateral margins.

Meso- and meta-notum and dorsum of abdomen same color as pronotum.

Ventral surface of abdomen lighter colored, with long, golden-yellow pubescence.

Legs yellow, long, with pubescence.

Measurements.

- Length of entire worker: 3.60-4.00 mm.
- Length of abdomen and thorax together: 2.75-3.00 mm.
- Length of head: 1.40-1.50 mm.
- Length of hind tibia: 1.10 mm.
- Width of head: 1.10 mm.

Described from a series of workers found with the typical soldier.

Type locality.—San Pedro, Spanish Honduras. San Pedro is inland, the terminus of the railroad from Puerto Cortes.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February–March, 1920.

Type, soldier.—Cat. No. 24575, U.S.N.M.

CONSTRICOTERMES (TENUIROSTRITERMES) BRICIAE, new species.

Soldier (pl. 3, figs. 12 and 13).—Head light castaneous-brown, nasus darker, except at tip, the heads of some soldiers (immature?) straw colored; deeply constricted, head and nasus similar in shape to *Constrictotermes incisus* Snyder, but head and body longer, broader, and thicker: head broadest at base, at angle to thorax. Hairs and bristles on head as in *C. incisus*. Ventral portion of head slightly lighter colored.

Antennae yellow-brown, 13 segments, pubescent; first segment long, cylindrical, stout; second short, more slender, cylindrical, less than half the length of the first; third clavate, long, slender, tapering at the base, twice the length of the second; fourth equals second; fifth shorter than third; last segment long, slender, subovate.

Pronotum light yellow-brown, saddle-shaped, wider than long, longer than in *incisus*, short pubescence on anterior area and few long bristles on anterior and lateral margins.

Meso- and meta-notum same color as pronotum, longer than in *incisus*.

Dorsum of abdomen slightly darker (grayish); ventral surface lighter colored; abdomen with long golden-yellow pubescence.

Legs yellowish, long and slender.

Measurements.

Length of entire soldier: 3.25–3.85 mm.

Length of head and nasus: 1.40–1.50 mm.

Length of head without nasus: 0.75–1.0 mm.

Length of nasus: 0.450–0.50 mm.

Length of abdomen and thorax together: 2.10–2.70 mm.

Length of pronotum: 0.105–0.107 mm.

Length of hind tibia: 0.808–1.10 mm.

Width of head: 0.602–0.605 mm.

Width of pronotum: 0.400–0.430 mm.

Worker.—Head light castaneous-brown, broadest at base of antennae, tapers posteriorly where rounded, longer than broad; with short pubescence. Post-clypeus yellow, about twice as broad as long, projecting. Labrum yellowish, broadest at middle, approximately same shape as in *incisus*, pubescent on anterior area.

Antennae yellow to yellow-brown, longer than head, 14 segments, with long pubescence; first segment long, stout, cylindrical; second,

short, more slender, clavate; third, long, slender, narrow at base, clavate, twice the length of the second; fourth, shorter, clavate; fifth, longer; last segment, slender, long, subovate.

Pronotum lighter than head, saddle-shaped, broader than long, with some long bristles and short pubescence on surface and margins.

Meso- and meta-notum same color as pronotum.

Dorsum of abdomen slightly darker, grayish brown, ventral surface lighter; abdomen with long golden-yellow pubescence.

Legs yellow, long, pubescent.

Measurements.

Length of entire worker: 4.25-4.60 mm.

Length of abdomen and thorax together: 3.25-3.40 mm.

Length of head: 1.4-1.5 mm.

Length of hind tibia: 1.0-1.10 mm.

Width of head: 1.10-1.20 mm.

Described from a series of workers found with the typical soldier.

A lighter colored, larger, longer, and broader species than *C. incisus*, shape of head equally strikingly perconstricted or deeply incised.

Named in honor and memory of my mother, née Alice Celinda Brice.

Type locality.—Lombardia, Spanish Honduras. Lombardia is north and inland from Ceiba, which is on the coast.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February-March, 1920.

Type, soldier.—Cat. No. 24576, U.S.N.M.

Genus ANOPLOTERMES Fritz Müller.

Species of this genus have no soldier caste. But few species are known and most of these are from America. Certain species in the Tropics build large mounds.

The worker caste is usually of a dirty gray color, and workers have the habit of moving about in files or lines.

ANOPLOTERMES GRACILIS, new species.

Winged adult.—Head dark brown, not as broad as in *A. ater* Hagen, broadest at the eye, broader than pronotum, rounded posteriorly, densely pubescent, hairs long and golden-yellow; head longer than broad; fontanelle indistinct. Post-clypeus yellow-brown, over twice as broad as long, projecting, pubescent; in *ater* fully three times as broad as long and not at all bulging out or projecting. Labrum yellow, elongate, subtriangular, rounded at tip, pubescent, extends to tip of mandibles; mandibles not as long as in *A. fumosus*

Hagen. (*A. ater* has the mandibles fairly long, but also not as long as in *fumosus*.) Eyes black, large, nearly round, not as projecting as in *ater*, very near lower margin of head, separated from both anterior or posterior margin of head by a distance less than an eye diameter. Ocellus large, elongate, deeply inset (with projecting upper rim), separated from the compound eye by a distance less than its short diameter, set obliquely to eye.

Antennae yellow-brown, slender, 15 segments, pubescent; first segment long, stout, cylindrical; second shorter, subclavate; third very short; fourth longer but shorter than second; last segment slender, subovate.

Pronotum yellow-brown, somewhat broader than long, not broader than head, broadest at anterior margin, anterior and posterior margins straight, lateral margins angularly, posteriorly sloping, dark brown markings on anterior area, long pubescence on lateral margins.

Meso- and meta-notum dark brown, with long pubescence, emarginate on posterior margins.

Wing dark, ciliate on margin, 8.5 mm. long, median usually branching at apex, 0 to 3 branches, cubitus (submedian) with 9-11 branches, median nearer to cubitus than to costal veins (pl. 5, fig. 22).

Abdomen with tergites dark brown, with dense, short and long, golden-yellow pubescence, less broad than in *ater*, not so stout.

Legs yellow-brown, slender, fairly elongate.

Measurements.

Length of entire winged adult: 9.5-11 mm.

• Length of entire dealated adult: 5.5-6.5 mm.

Length of head (to tip labrum): 0.90-1.0 mm.

Length of pronotum: 0.402-0.500 mm.

Length of hind tibia: 0.800 mm.

Length of anterior wing: 10.5 mm.

Length of wing scale: 0.500 mm.

Width of head (at eyes): 0.65-0.75 mm.

Diameter of eye: 0.202-0.207 mm.

Width of pronotum: 0.65+mm. (curled down).

Width of anterior wing: 2.65 mm.

A lighter colored, shorter species than *A. ater*.

Type locality.—Ancon, Canal Zone, Panama.

Described from a large series of winged adults, collected at the type locality by H. F. Dietz, April 19, 1919, in outer wall of wasps' nest on royal palm tree; Dietz Acc. No. G. 475a, Hopk. U. S. No. 14124h; winged adults were also collected at Panama City, Panama, by H. F. Dietz and I. Molino, on April 19, 1919, at lights in houses.

Type, winged male adult.—Cat. No. 24573, U.S.N.M.

ANOPLOTERMES MANNI, new species.

Worker.—Head and thorax white with tinge of yellow. Head longer than broad, broadest where antennae are attached and tapers

from here to posterior margin of head which is rounded; with long pubescence. Post-clypeus projecting, not twice as broad as long; labrum elongate, subtriangular, rounded at tip, with long pubescence.

Antennae white, but somewhat yellowish and widening out toward apex; 14 segments, pubescent; first segment, elongate, stout, cylindrical; second short, not much narrower than first; third and fourth approximately subequal, ring-like and short, last segment longest and subovate.

Pronotum saddle-shaped, with long pubescence.

Abdomen fusiform, dirty gray in color, with long light colored pubescence.

Legs white with tinge of yellow; tibiae of front legs markedly swollen, as is usual in species of this genus.

Measurements.

Length of entire worker: 2.65-3.25 mm.

Length of abdomen and thorax together: 2.0-2.5 mm.

Length of head: 0.65-0.70 mm.

Length of hind tibia: 0.303-0.307 mm.

Width of head: 0.402-0.405 mm.

A small but elongate and slender worker. Named in honor of Dr. W. M. Mann, of the Bureau of Entomology, United States Department of Agriculture, who has collected many species of termites in the Tropics. It is unusual to base a species on a worker, but this worker seems to be quite distinct, and a name is desirable to assign the termitophiles which were found with this species.

Type locality.—Lombardia, Spanish Honduras. Lombardia is north and inland from Ceiba, which is on the coast.

Described from a series of workers, collected at the type locality by Dr. W. M. Mann, February-March, 1920, beneath deeply embedded stone, termitophiles present.

Type, worker.—Cat. No. 24574, U.S.N.M.

EXPLANATION OF PLATES.

Drawings made by Miss Eleanor T. Armstrong, of the Bureau of Entomology.

PLATE 1.

New Species of Kaloterme and Armiterme.

- FIG. 1. *Kaloterme tuberculifrons* Snyder. Soldier. Dorsal view of head and pronotum showing tubercles on front of head. (Enlarged approx. 12 X.)
2. *Kaloterme cubanus* Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 12 X.)
3. *Armiterme intercedius* Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 15 X.)

PLATE 2.

A new Cryptoterme with front of pronotum serrate in soldier caste.

- FIG. 4. *Cryptoterme thompsonae* Snyder. Winged adult. Dorsal view of head, showing hyaline markings on head. (Enlarged approx. 30 X.)
5. *Cryptoterme thompsonae* Snyder. Soldier. Lateral view of head and pronotum. (Note serrate front of pronotum.) (Enlarged approx. 25 X.)
6. *Cryptoterme thompsonae* Snyder. Soldier. Three quarters view of head and pronotum. (Enlarged approx. 25 X.)
7. *Cryptoterme thompsonae* Snyder. Soldier. Dorsal view of pronotum. (Enlarged approx. 25 X.)
8. *Cryptoterme thompsonae* Snyder. Soldier. Dorsal view of left mandible, showing marginal teeth. (Enlarged approx. 30 X.)
9. *Cryptoterme thompsonae* Snyder. Soldier. Dorsal view of right mandible, showing marginal teeth. (Enlarged approx. 30 X.)

PLATE 3.

Two new species of Constrictoterme with perconstricted heads.

- FIG. 10. *Constrictoterme incisus* Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 35 X.)
11. *Constrictoterme incisus* Snyder. Soldier. Lateral view of head and pronotum. (Enlarged approx. 30 X.)
12. *Constrictoterme briciae* Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 35 X.)
13. *Constrictoterme briciae* Snyder. Soldier. Lateral view of head and pronotum. (Enlarged approx. 35 X.)

PLATE 4.

Wing venation of Kalotermitidae.

- FIG. 14. *Kaloterme montanus* Snyder. Venation of fore wing. (Enlarged approx. 7.5 X.)
15. *Kaloterme immigrans* Snyder. Venation of hind wing of type. (Enlarged approx. 12 X.)
16. *Neoterme connexus* Snyder. Venation of fore wing. (Enlarged approx. 8 X.)

PLATE 5.

Wing venation of Kalotermitidae and Termitidae.

- FIG. 17. *Cryptotermes rospigliosi* Snyder. Venation of fore wing. (Enlarged approx. 10 X.)
18. *Cryptotermes piceatus* Snyder. Venation of fore wing of type. (Enlarged approx. 8 X.)
19. *Cryptotermes piceatus* Snyder. Venation of hind wing of type. Note differences in median vein. (Enlarged approx. 8 X.)
20. *Cryptotermes brevis* Walker. Venation of fore wing. (Enlarged approx. 12 X.)
21. *Coptotermes niger* Snyder. Venation of fore wing. (Enlarged approx. 10 X.)
22. *Anoplotermes gracilis* Snyder. Venation of fore wing. (Enlarged approx. 10 X.)